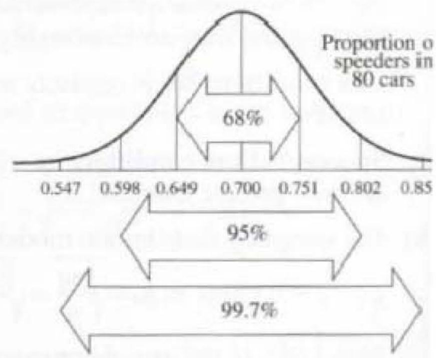
Text Solutions: pg. 428—431, #7, 9, 11, 13, 15

7. Speeding.

a) $\mu_{\hat{p}} = p = 0.70$

$$\sigma(\hat{p}) = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(0.7)(0.3)}{80}} \approx 0.051.$$

About 68% of the sample proportions are expected to be between 0.649 and 0.751, about 95% are expected to be between 0.598 and 0.802, and about 99.7% are expected to be between 0.547 and 0.853.



b) Randomization condition: The sample may not be representative. If the flow of traffic is very fast, the speed of the other cars around may have some effect on the speed of each driver. Likewise, if traffic is slow, the police may find a smaller proportion of speeders than they expect.

10% condition: 80 cars represent less than 10% of all cars

Success/Failure condition: $np = 56$ and $nq = 24$ are both greater than 10.

The Normal model may not be appropriate. Use caution. (And don't speed!)

9. Loans.

a) $\mu_{\hat{p}} = p = 7\%$

$$\sigma(\hat{p}) = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(0.07)(0.93)}{200}} \approx 1.8\%$$

b) Randomization condition: Assume that the 200 people are a representative sample of all loan recipients.

10% condition: A sample of this size is less than 10% of all loan recipients.

Success/Failure condition: $np = 14$ and $nq = 186$ are both greater than 10.

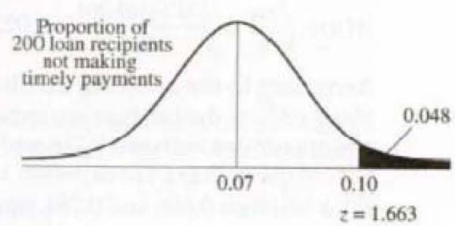
Therefore, the sampling distribution model for the proportion of 200 loan recipients who will not make payments on time is $N(0.07, 0.018)$.

c) According to the Normal model, the probability that over 10% of these clients will not make timely payments is approximately 0.048.

$$z = \frac{\hat{p} - \mu_{\hat{p}}}{\sqrt{\frac{pq}{n}}}$$

$$z = \frac{0.10 - 0.07}{\sqrt{\frac{(0.07)(0.93)}{200}}}$$

$$z \approx 1.663$$



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11. Back to school?

Randomization condition: We are considering colleges with freshman classes of 400 students. These are not random samples, and not all of the colleges considered may be typical of all colleges. We should be careful using this sampling distribution model.

10% Condition: 400 students is less than 10% of all college students.

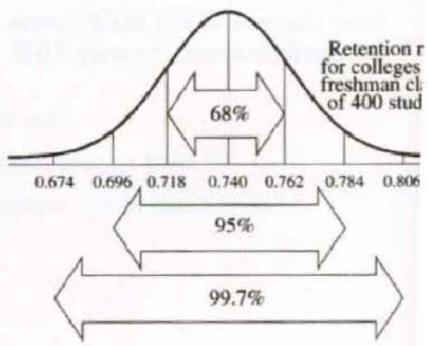
Success/Failure condition: $np = 296$ and $nq = 104$ are both greater than 10.

Therefore, the sampling distribution model for $\hat{p}$ is Normal, with:

$$\mu_{\hat{p}} = p = 0.74$$

$$\sigma(\hat{p}) = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(0.74)(0.26)}{400}} \approx 0.022$$

According to the sampling distribution model, about 68% of the colleges are expected to have retention rates between 0.718 and 0.762, about 95% of the colleges are expected to have retention rates between 0.696 and 0.784, and about 99.7% of the colleges are expected to have retention rates between 0.674 and 0.806. However, the conditions for the use of this model may not be met. We should be cautious about making any conclusions based on this model.



13. Back to school, again.

Provided that the students at this college are typical, the sampling distribution model for the retention rate, $\hat{p}$, is Normal with $\mu_{\hat{p}} = p = 0.74$ and standard deviation

$$\sigma(\hat{p}) = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(0.74)(0.26)}{603}} \approx 0.018$$

This college has a right to brag about their retention rate. $522/603 = 86.6\%$ is over 7 standard deviations above the expected rate of 74%.

15. Polling.

Randomization condition: We must assume that the 400 voters were polled randomly.

10% condition: 400 voters polled represent less than 10% of potential voters.

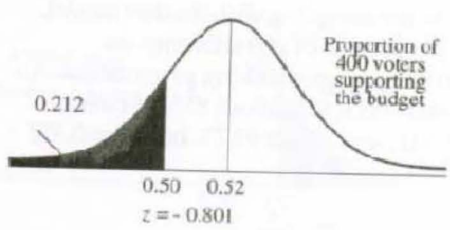
Success/Failure condition: $np = 208$ and $nq = 192$ are both greater than 10.

Therefore, the sampling distribution model for $\hat{p}$ is Normal, with:

$$\mu_{\hat{p}} = p = 0.52$$

$$\sigma(\hat{p}) = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(0.52)(0.48)}{400}} \approx 0.025$$

According to the Normal model, the probability that the newspaper's sample will lead them to predict defeat (that is, predict budget support below 50%) is approximately 0.212.



$$z = \frac{\hat{p} - \mu_{\hat{p}}}{\sqrt{\frac{pq}{n}}}$$

$$z = \frac{0.50 - 0.5}{\sqrt{\frac{(0.52)(0.4}{400}}}$$

$$z = -0.801$$